PROCEEDINGS OF SPIE

Automatic Target Recognition XXXIII

Riad I. Hammoud Timothy L. Overman Abhijit Mahalanobis Editors

1-4 May 2023 Orlando, Florida, United States

Sponsored by SPIE

Cosponsored by Prime Solutions Group, Inc. (United States) Lockheed Martin Corporation (United States)

Published by SPIE

Volume 12521

Proceedings of SPIE 0277-786X, V. 12521

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

Automatic Target Recognition XXXIII, edited by Riad I. Hammoud, Timothy L. Overman, Abhijit Mahalanobis, Proc. of SPIE Vol. 12521, 1252101 · © 2023 SPIE · 0277-786X · doi: 10.1117/12.2690641 The papers in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIEDigitalLibrary.org.

The papers reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from these proceedings: Author(s), "Title of Paper," in *Automatic Target Recognition XXXIII*, edited by Riad I. Hammoud, Timothy L. Overman, Abhijit Mahalanobis, Proc. of SPIE 12521, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X ISSN: 1996-756X (electronic)

ISBN: 9781510661561 ISBN: 9781510661578 (electronic)

Published by **SPIE** P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time) SPIE.org Copyright © 2023 Society of Photo-Optical Instrumentation Engineers (SPIE).

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of fees. To obtain permission to use and share articles in this volume, visit Copyright Clearance Center at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher.

Printed in the United States of America by Curran Associates, Inc., under license from SPIE.

Publication of record for individual papers is online in the SPIE Digital Library.



Paper Numbering: A unique citation identifier (CID) number is assigned to each article in the Proceedings of SPIE at the time of publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc. The CID Number appears on each page of the manuscript.

Contents

v Conference Committee

STATISTICAL METHOD II

- 12521 04 Compound variance gamma distribution for modeling randomly scattered signals and detection at two sensors [12521-3]
- 12521 06 Casting scene context into a Bayesian framework for automated target recognition [12521-5]

MACHINE LEARNING FOR ATR I

- 12521 07 Efficient hyperparameter optimization for ATR using homotopy parametrization (Best Student Paper Award) [12521-6]
- 12521 08 How much data is required for a transformer-based infrared small target detection? [12521-7]
- 12521 09 Deep transductive transfer learning for automatic target recognition (Best Paper Award) [12521-8]

SYNTHETIC APERTURE RADAR ATR

- 12521 OC Class disagreement detection with its application to EO-SAR fusion (Invited Paper) [12521-12]
- 12521 0D PAHD: perception-action-based human decision making using explainable graph neural networks on SAR images [12521-13]

MACHINE LEARNING FOR ATR II

- 12521 OF Synthetically generated image dataset for military relevant machine learning experiments (Invited Paper) [12521-15]
- 12521 OH A few shots at few shot learning [12521-17]
- 12521 01 Underwater target detection, localization, and classification [12521-19]
- 12521 0J A comparative study of joint video tracking and classification for countering unmanned aerial vehicles [12521-20]

	AI/DL TECHNOLOGY APPLIED IN ATR AND IR SYSTEMS I: JOINT SESSION WITH CONFERENCES 12521 AND 12534
12521 OK	Explorations in transfer learning and machine learning architectures utilizing the DSIAC ATR algorithm development data set (Invited Paper) [12521-21]
12521 OL	Smart transfer learning from pre-trained networks: a case study for infrared classification [12521-22]
	AI/DL TECHNOLOGY APPLIED IN ATR AND IR SYSTEMS II: JOINT SESSION WITH CONFERENCES 12521 AND 12534
12521 OM	Leveraging environmental conditions to inform a two-step ATR for buried objects [12521-23]
12521 ON	Data pipeline of a multi-spectral satellite experiment for object detection and artificial intelligence-based processing [12521-24]
	AI/DL TECHNOLOGY APPLIED IN ATR AND IR SYSTEMS III: JOINT SESSION WITH CONFERENCES 12521 AND 12534
12521 00	Enhanced target recognition using quadratic correlation filter networks [12521-25]
12521 0Q	Unsupervised domain adaptation for multispectral object detection [12521-27]
	ATR SYSTEMS AND IMPLEMENTATION I
12521 OS	Support emergency response in automatic identification system using an opportunistic resource utilization networks [12521-30]
12521 OT	Automatic target detection utilizing an edge IR vision transformer (EIR-ViT) [12521-31]
	ATR SYSTEMS AND IMPLEMENTATION II
12521 OU	An adaptive asymmetric loss function for positive unlabeled learning (Invited Paper, Best Paper Award) [12521-38]
12521 OV	Generating synthetic data and training muzzle flash detection systems using GANs [12521-33]

Conference Committee

Symposium Chairs

Tien Pham, The MITRE Corporation (United States) Douglas R. Droege, L3Harris Technologies, Inc. (United States)

Symposium Co-chairs

Augustus W. Fountain III, University of South Carolina (United States) Teresa L. Pace, L3Harris Technologies, Inc. (United States)

Program Track Chair

David W. Messinger, Rochester Institute of Technology (United States)

Conference Chairs

Riad I. Hammoud, PlusAI, Inc. (United States) Timothy L. Overman, Prime Solutions Group, Inc. (United States) Abhijit Mahalanobis, The University of Arizona (United States)

Conference Program Committee

Kenny K. Chen, Lockheed Martin Missiles and Fire Control (United States) Leon Cohen, Hunter College (United States) Frederick D. Garber, Wright State University (United States) Izidor Gertner, The City College of New York (United States) Megan King, U.S. Army Combat Capabilities Development Command (United States) **Bing Li**, Lockheed Martin Corporation (United States) Jason P. Luck, Lockheed Martin Missiles and Fire Control (United States) Asif Mehmood, Joint Artificial Intelligence Center (United States) Olga Mendoza-Schrock, Air Force Research Laboratory (United States) **Robert R. Muise**, University of Central Florida (United States) Nasser M. Nasrabadi, West Virginia University (United States) Lakshmanan Nataraj, Mayachitra, Inc. (United States) Saurabh Prasad, University of Houston (United States) Vahid R. Riasati, California State University, Northridge (United States) Firooz A. Sadjadi, Emerging Concepts Laboratory LLC (United States) Cem Safak Sahin, Systems & Technology Research (United States)

Angel D. Sappa, ESPOL Polytechnic University (Ecuador) and Vintra Inc. (United States) and Universitat Autònoma de Barcelona (Spain)

Jason R. Stack, Office of Naval Research (United States) Michael Teutsch, HENSOLDT Optronics GmbH (Germany) Alan J. Van Nevel, Naval Air Warfare Center Aircraft Div. (United States)

Vincent J. Velten, Air Force Research Laboratory (United States) Donald Waagen, Air Force Research Laboratory (United States) Edmund Zelnio, Air Force Research Laboratory (United States)